Fish ->

$$fitness = 0 \quad , \quad position, rotation, colour = rand(0,1)$$
$$eyes = forward \quad , \quad speed = rand(0,2) \quad , \quad turn = 0 \quad , \quad not\,dead$$

Neural Net ->

$$inputs = \begin{Bmatrix} closestObj_x, closestObj_y \\ look_x, look_y \end{Bmatrix}$$
$$outputs = \begin{Bmatrix} turn = out_A - out_B, & max: \pm 0.3 \\ speed = out_A + out_B \end{Bmatrix}$$

Neuron ->

$$weight_{default} = rand(0,1)$$
$$input_{net} = \left(\sum_{i=0}^{last\,input} weight_i * input_i \right) - weight_{last}$$
$$output = \frac{1}{1 + e^{-input_{net}}}$$

Evolution ->

1) Get Genes of 2 best fish – they are copied into the next generation as is

2) All the fish (including the two best) are then cross-breeded randomly to create the remaining fish.

3) Bred fish have a 10% chance per gene of mutation. If the mutation occurs, the gene changes by a random amount ±30%.

4) All fish in the pool are restored to life and their genes overridden with the new generation's.

Genome ->

*each weight for each neuron is a separate gene (6*5 + 4*7 = 44 vars)*

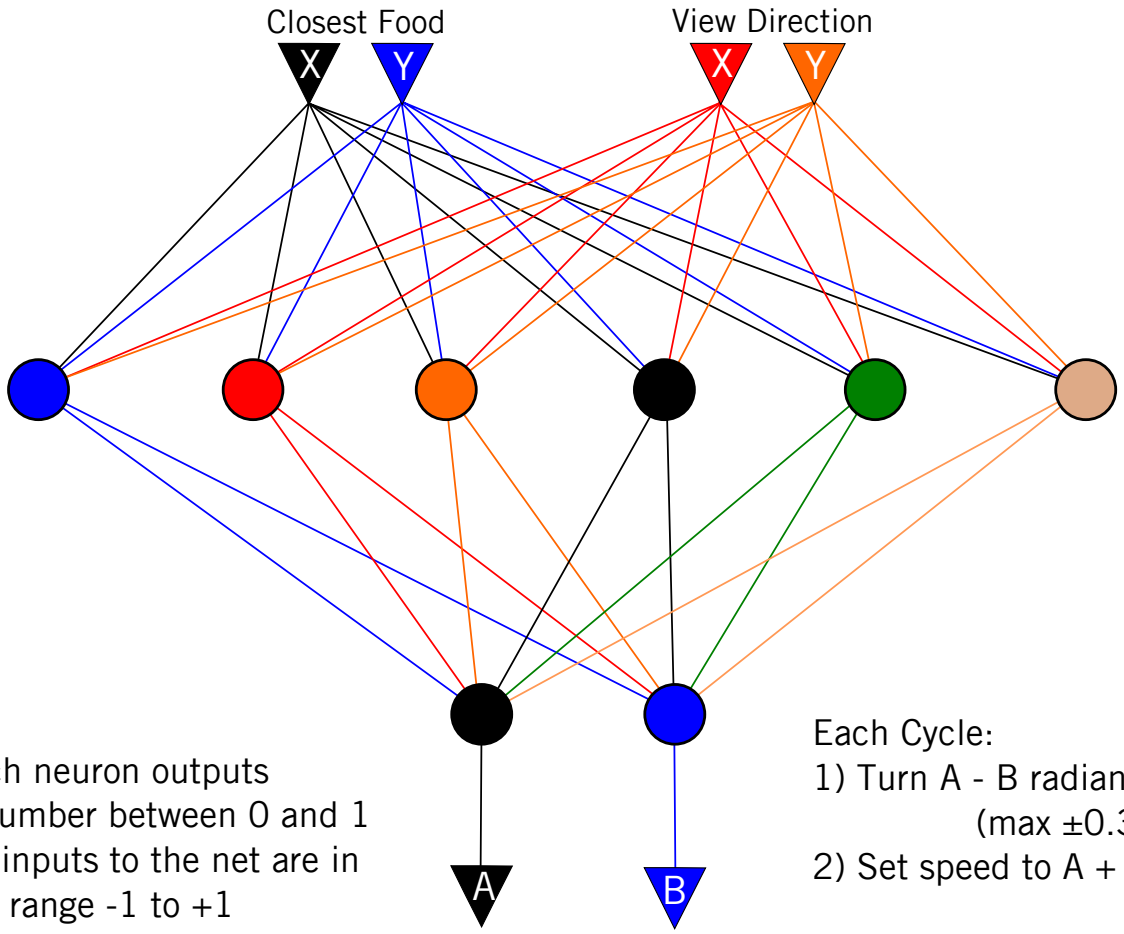
the colour of the fish is a gene (1 var)

= 45 distinct variables

Observations:

- **clicking on a fish is the only way to "kill" them**
- **fish.fitness += 1 for each food bit eaten**
- **turn is in radians**
- **the fish always looks straight forward**
- **neurons output in a range between 0 and 1**
- **speed will always be in the range 0.0 – 2.0**
- **tank-tread-like turning system**
- **turning should slow down the fish**

The Neural Network



each neuron outputs
a number between 0 and 1
All inputs to the net are in
the range -1 to +1

Each Cycle:
1) Turn A - B radians
(max ±0.3)
2) Set speed to A + B